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Performance catastrophes in sport: A test of the hysteresis hypothesis

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An experiment is reported which tests Fazey and Hardy's (1988) catastrophe model of anxiety and performance. Eight experienced crown green bowlers performed a bowling task under conditions of high and low cognitive anxiety. On each of these occasions, physiological arousal (measured by heart rate) was manipulated by means of physical work in such a way that the subjects were tested with physiological arousal increasing and decreasing. A repeated-measures three-factor ANOVA was used to test the hysteresis hypothesis that the performance × heart rate graph would follow a different path for heart rate increasing compared with heart rate decreasing in the high cognitive anxiety condition, but not in the low cognitive anxiety condition. The ANOVA revealed the predicted three-way interaction of cognitive anxiety, heart rate, and the direction of change in heart rate upon performance, with follow-up tests indicating that the interaction was due to hysteresis occurring in the high cognitive anxiety condition but not in the low cognitive anxiety condition. Other statistical procedures showed that, in the high cognitive anxiety condition, subjects' best performances were significantly better, and their worst performances significantly worse, than in the low cognitive anxiety condition. However, the results did not provide unequivocal support for the catastrophe model of anxiety and performance.

Keywords: Anxiety, bowls, catastrophes, performance, stress.

Introduction

Recent studies of the anxiety–performance relationship have used multidimensional anxiety theory as a conceptual framework from which to derive their hypotheses (Burton, 1988; Martens *et al.*, 1990; Morris *et al.*, 1981). This theory argues that at least two different components can be distinguished in the anxiety response – a cognitive component associated with concerns about performing well, and a somatic component reflecting perceptions of the physiological response to psychological stress. The theory proposes that these two components are conceptually independent and have different antecedents. More precisely, Martens *et al.* (1990) and others have argued that somatic anxiety is a conditioned response to entering the performance arena, so that it should be elevated immediately prior to the start of an event, and dissipate once performance commences. They have also argued that since cognitive anxiety reflects negative concerns about the consequences of failure, it should only change when the subjective probability of success changes.

The basic prediction of multidimensional anxiety theory is that because somatic anxiety is hypothesized to dissipate once performance commences, while the subjective probability of success is free to vary throughout performance, cognitive anxiety should be the primary influence upon performance and this influence should be negative in nature (Martens *et al.*, 1990). Several studies have employed polynomial regression analyses to examine the relationship between the different components of competitive state anxiety and performance on the day of an event. In general, these studies have obtained negative linear relationships between cognitive anxiety and sports performance (Gould *et al.*, 1984; Burton, 1988), but inverted-U shaped relationships between somatic anxiety and sports performance (Gould *et al.*, 1987; Burton, 1988). This situation is complicated by the fact that other studies which have employed a different paradigm to manipulate cognitive and somatic anxiety independently have produced results which appear to contradict these findings. Parfitt *et al.* (1990) discussed a number of studies which have demonstrated improvements in the mean performance of cognitively anxious performers during the days leading up to an

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important competition when somatic anxiety was low, but mixed positive and negative effects associated with elevated somatic anxiety on the day of the competition when cognitive anxiety was high. The precise nature of these effects was different for different performance tasks. These apparent contradictions could be due to an interaction between cognitive and somatic anxiety such that cognitive anxiety has a negative effect upon performance when somatic anxiety is high on the day of an important event, but a positive effect upon performance when somatic anxiety is low during the days prior to an important event. Consequently, a fundamental problem with multidimensional anxiety theory is that it attempts to explain a possible three-dimensional relationship between cognitive anxiety, somatic anxiety and performance in terms of a series of two-dimensional relationships. More precisely, it makes predictions only about the separate relationships between cognitive anxiety and performance, and somatic anxiety and performance, when what may be required is an explanation of how cognitive and somatic anxiety interact to influence performance. This conclusion seems to imply that any satisfactory model of anxiety and performance must be at least three-dimensional in nature. Because of their general dissatisfaction with the inverted-U hypothesis and other models of anxiety and performance, Hardy and associates (Fazey and Hardy, 1988; Hardy, 1990; Hardy and Parfitt, 1991) proposed a catastrophe model of anxiety and performance, which attempted to clarify the relationship between cognitive anxiety, physiological arousal and performance.

It is perhaps appropriate at this stage to say something about the choice of physiological arousal as an independent variable in the catastrophe model in preference to somatic anxiety. Physiological arousal was conceptualized as the organism's phasic physiological response to environmental stimuli (Pribram and McGuinness, 1975). In the context of anxiety, such physiological responses might be best thought of in terms of the classic 'fight/flight' response to threatening stimuli (Cannon, 1953). Fazey and Hardy argued that this response may be partially reflected by somatic anxiety, or other physiological indicators of arousal. However, the idiosyncrasies of different situations, physiological subsystems and task demands could superimpose specific deviations from the generalized response of any physiological indicators (Lacey, 1967); so that if the physiological demands of the task were small, these specific differences in particular physiological subsystems could obscure the general trend of the physiological arousal response (Lacey, 1967; Neiss, 1988). Nevertheless, Fazey and Hardy felt that the general physiological response to performance anxiety was sufficiently well-established (Frankenhauser, 1980) for it to be meaningful to talk about physiological arousal as a generalized response within this context.

The distinction between physiological arousal and somatic anxiety is an important one. For, although several studies have shown that physiological arousal (as measured by heart rate) follows a similar time-course to somatic anxiety prior to an important event (Parfitt *et al.*, 1990), there are important differences regarding the means by which physiological arousal and somatic anxiety might exert an influence upon performance. Theoretically, physiological arousal could cause 'direct hit' effects upon performance by changing the availability of certain resources to performers (Hockey and Hamilton, 1983; Humphreys and Revelle, 1984; Parfitt *et al.*, 1990). Furthermore, a number of researchers have shown that the physiological arousal which is associated with anxiety continues to fluctuate during performance (Baddeley and Idzikowski, 1983; Cox *et al.*, 1983). Conversely, somatic anxiety is hypothesized to influence performance only if subjects become preoccupied with a negative interpretation of their symptoms (Burton, 1988; Martens *et al.*, 1990); it has also been hypothesized to dissipate once performance commences (Martens *et al.*, 1990).

Fazey and Hardy selected cognitive anxiety as the splitting factor in their cusp catastrophe model and physiological arousal as the normal factor. In this way, they proposed that cognitive anxiety determines whether performers interpret their physiological arousal symptoms positively or negatively, thereby determining whether the effects of physiological arousal upon performance will be small and continuous, large and discontinuous, or somewhere in between these two extremes (see Fig. 1). The model therefore allows the possibility of physiological arousal exerting both direct and indirect effects upon performance.

The roles for cognitive anxiety and physiological arousal were selected so that the model would account for the following anomalies in the anxiety–performance literature. When cognitive anxiety is low, the relationship between physiological arousal and performance is uniform or inverted-U shaped as shown by the back face of Fig. 1 (see, e.g. Davey, 1973). When physiological arousal is high on the day of an important event, there is a negative correlation between cognitive anxiety and performance, as shown by the right-hand face of Fig. 1 (cf. Burton, 1988; Gould *et al.*, 1984). When physiological arousal is low during the days prior to an important event, elevated cognitive anxiety is associated with enhanced performance relative to baseline data, as shown by the left-hand face of Fig. 1 (cf. Parfitt *et al.*, 1990). Finally, when cognitive anxiety is high on the day of an event, the effects of physiological arousal can either be positive or negative relative to baseline conditions, depending upon exactly how high cognitive anxiety and physiological

arousal are (cf. Parfitt *et al.*, 1990; Jones and Cale, 1989). This manipulation represents a slice through Fig. 1 parallel to the physiological arousal × performance plane.

A fundamental prediction of the catastrophe model is that under conditions of high cognitive anxiety, hysteresis will occur; that is to say, performance will follow a different path when physiological arousal is increasing to the path that it follows when physiological arousal is decreasing (see front face of Fig. 1). Under conditions of low cognitive anxiety, hysteresis will not occur, and the physiological arousal–performance curve will follow the same path whether physiological arousal is increasing or decreasing (see back face of Fig. 1).

According to catastrophe theory (Zeeman, 1976), the *precise* shape of the cusp catastrophe's behavioural surfaces, together with their location and orientation in space, are free to vary within the constraint that the number of folds in the surface remains the same. Following this line of reasoning, it could be argued that the upper and lower behaviour surfaces of the anxiety–performance catastrophe model can be inclined positively or negatively with respect to the cognitive anxiety axis, provided that the upper surface remains above the lower surface. However, Hardy and associates explicitly defined their model in such a way that the upper behaviour surface was positively inclined to the cognitive anxiety axis and the lower surface was negatively inclined to it (Fazey and Hardy, 1988; Hardy, 1990). Thus, a second prediction of the model is that subjects' performance should be significantly better, and their worst performance significantly worse, under conditions of high cognitive anxiety than under conditions of low cognitive anxiety.

Three hypotheses were subsequently formulated from these predictions: (1) hysteresis will occur under conditions of high cognitive anxiety, but not under conditions of low cognitive anxiety; (2) each subject's best performance will be significantly better under conditions of high cognitive anxiety than his or her best performance under conditions of low cognitive anxiety; and (3) each subject's worst performance will be significantly worse under conditions of high cognitive anxiety than his or her worst performance under conditions of low cognitive anxiety.

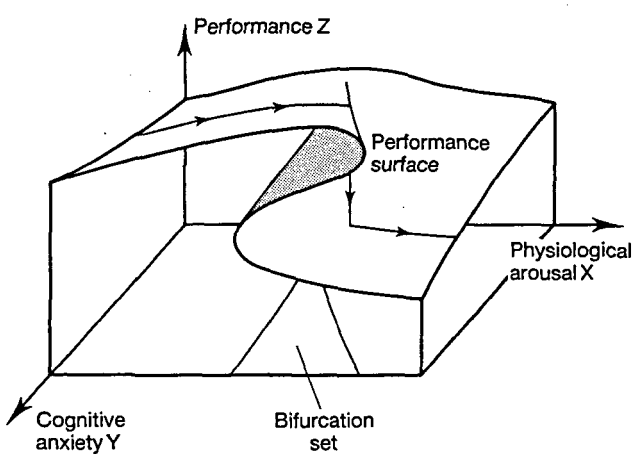

Figure 1 Fazey and Hardy's (1988) cusp catastrophe model of anxiety and performance (reproduced with the permission of The National Coaching Foundation, Leeds).

These hypotheses were tested by Hardy and Parfitt (1991) using female basketball players performing a set shot criterion task. Cognitive anxiety was manipulated by testing subjects 2 days before and 2 days after an important basketball tournament. Physiological arousal was then manipulated by means of physical work in such a way that the subjects were tested with physiological arousal increasing and with physiological arousal decreasing. Set shot performance demonstrated hysteresis under conditions of high cognitive anxiety, but not under conditions of low cognitive anxiety. Hardy and Parfitt (1991) also showed that subjects' maximum performances were significantly higher, their minimum performances significantly lower, and their greatest decrements in performance significantly greater in the high cognitive anxiety condition than in the low cognitive anxiety condition. These findings were interpreted as offering support for the catastrophe model; however, they were not completely unequivocal. Hardy and Parfitt (1991) obtained significant differences in both somatic and cognitive anxiety when they attempted to manipulate cognitive anxiety across treatment conditions. They suggested that subjects' somatic anxiety 2 days before their competition may have reflected anxiety about the demands of the experiment rather than anxiety about the impending competition. They also argued that this effect did not confound their results for three reasons: the independent variable in question in the catastrophe model was physiological arousal and not somatic anxiety; physiological arousal and somatic anxiety are not generally highly correlated with each other (Hardy and Whitehead, 1984; Yan Lan and Gill, 1984); and even if the changes in somatic anxiety did reflect a global change in baseline physiological arousal from one day to the other, the independent variables in the catastrophe model had still been manipulated independently of each other. The present study was an attempt to replicate Hardy and Parfitt's (1991) findings using a different sport, male subjects instead of female subjects, and a different cognitive anxiety manipulation.

Methods

Subjects

The subjects were eight experienced crown green bowlers from the Birmingham Senior Bowls League.

They were all male, and aged between 18 and 23 years ($\bar{x}$+S.D.=20.83±1.37 years).

Design

The subjects were not informed of the true purpose of the experiment. They were told that the experimenters were interested in the effects of physical fitness upon performance under different performance conditions. An instructional set was used to manipulate cognitive anxiety independently of somatic anxiety. Although previous research (Morris *et al.*, 1981) has shown that such manipulations can be successful in evaluative settings, they do not appear to have been performed before in a sport context. The subjects were tested on two different days, one with a neutral instructional set and the other with an ego-threatening instructional set. The ego-threatening set indicated to the bowlers that their personal scores for that day would be compared with similar scores obtained from elite crown green bowlers, and that they would have to try very hard if they were to perform well in comparison with these players. They were also told that they would be given their results at the end of the experiment. In the neutral set condition, the subjects were informed that their individual data would not be compared with anyone else's, and that their scores would be lumped together with other players of a similar standard in order to expand our database for future work.

On each of the test days, physiological arousal was manipulated by means of physical exercise, and monitored by measuring heart rate. For each subject, heart rate frequency bands were constructed in increments of 10 beats min^{-1}, ranging from their maximum heart rate down to their maximum heart rate minus 40. For example, if a subject's maximum heart rate was 200 beats min^{-1}, then his top frequency band would be 190–200 beats min^{-1}, and his bottom frequency band would be 150–160 min^{-1}. The subjects' physiological arousal levels were increased by having them perform shuttle runs until the required frequency band was reached, or decreased by allowing them to sit and rest until the required frequency band was reached.

The criterion task required the subjects to bowl three balls at a jack placed 25 m from a bowling mat. This task was considered to be a relevant and appropriate task to ask crown green bowlers to perform.

Procedure

Prior to the first data collection, two familiarization sessions were completed by all the subjects. In the first session, each subject's maximum heart rate was obtained by the subject performing repeated shuttle runs to exhaustion. This was crucial to the experimental design, as the subjects were required to perform the criterion task while working up to their maximum heart rate and then back down, or vice versa. In the second session, the subjects were required to perform shuttle runs until they reached certain heart rate frequency bands, at which they were then required to perform the criterion task. This was not a complete run through of a data collection session, because such a session would have taken over 1 h per subject to complete, and the experimenters were concerned about losing subjects through placing excessive time demands upon them. Instead, each subject completed approximately one-third of a testing session so as to ensure that the procedure and situation were not novel. The subjects were reassured that the full data collection sessions would place only similar physical demands upon them. The first data collection took place on the day after the second familiarization day, with the second data collection taking place on the following day.

The subjects were tested individually at a crown bowling green. On arrival at the green, the subjects were fitted with a Polar Electro Sport Tester PE_{3000} heart rate microcomputer for monitoring heart rate. The apparatus comprised a transmitter, which was attached to a strap around the subject's chest, and a receiver, which was worn on the wrist. Once the apparatus had been tested, the subjects completed Martens and co-workers' (1990) Competitive State Anxiety Inventory-2 (CSAI-2) with respect to the impending performance test. The CSAI-2 is a situation-specific self-report anxiety inventory, which has been shown to give reliable and valid measures of cognitive anxiety, somatic anxiety and self-confidence in competitive situations (Martens *et al.*, 1990). Only the data from the cognitive anxiety and somatic anxiety subscales are reported here.

Having completed the CSAI-2, the subjects had 10 practice bowls after which they were given a task description sheet explaining the experimental procedure and what was required of them. The subjects were randomly divided into two groups. One group received the ego-threatening instructions on the first day and the neutral instructions on the second, whereas the other group received the instructional sets in the opposite order. Within these two groups, half of the subjects performed the criterion task with heart rate frequency bands increasing from maximum minus 40 (M−40) to maximum (MAX) and then decreasing back down to M−40, whereas the other half performed the task with heart rate frequency bands decreasing from MAX down to M−40, and then increasing back up to MAX. The subjects who started from their maximum heart rate frequency band in the first data session, started from their lowest heart rate frequency band in the second data session and vice versa. Thus, the experimental treatments were presented in a regular order, but with the frequency band increasing/decreasing condition balanced.

The heart rate apparatus allowed the required fre-

quency bands to be specified so that the apparatus would 'bleep' if the heart rate was outside that band. An audible signal was therefore available to indicate when some action was required, either to increase or decrease heart rate. Once the 10 practice bowls had been completed, the apparatus was set at the specified frequency band, which was either the subject's maximum heart rate frequency band or M−40 depending upon the group to which the subject belonged. The subject then performed shuttle runs or rested (as appropriate) until the 'bleeping' stopped, that is, until his heart rate reached the required frequency band. Once the frequency band was achieved, the subject had three bowls at the jack. Upon completion of the three bowls, the heart rate frequency band was either increased or decreased by 10 beats min^{-1} and the procedure repeated. In general, the subjects took approximately 3 min to increase (or decrease) their heart rate by 10 beats min^{-1}. In total, the subjects bowled 40 balls at the jack; 10 practice, and two sets of three at each heart rate frequency band (five going up and five going down). The experimenter recorded the distance that each attempt was away from the jack, and subsequently used this to calculate the mean absolute error for each set of three bowls. These mean absolute error scores were then transformed into performance scores using the transformation $f(x)=1/x$.

Results

As a preliminary analysis, correlated *t*-tests were performed on the cognitive and somatic anxiety components of the CSAI-2, so as to confirm that the cognitive anxiety manipulation had been successful. Preliminary inspection of the performance data suggested that use of analysis of variance was appropriate. Consequently, a three-factor analysis of variance, with repeated measures on each factor, was performed on the criterion task scores. The factors were cognitive anxiety (high cognitive anxiety *vs* low cognitive anxiety), direction (heart rate increasing *vs* heart rate decreasing) and heart rate frequency band (from M−40 to MAX). Thus, the performance data were subjected to a $2\times2\times5$ repeated-measures ANOVA. The hysteresis hypothesis predicted a significant three-way interaction, with performance following a different path for heart rate increasing compared with heart rate decreasing in the high cognitive anxiety condition, but not in the low cognitive anxiety condition.

Anxiety components analysis

The mean (±S.D.) scores for cognitive anxiety were 16.7 ± 3.11 under the neutral instructions and 29.0 ± 1.77 under the ego-threatening instructions. Furthermore, a correlated *t*-test showed that this difference was significant ($t_7=8.32$, $P<0.001$). The mean scores for somatic anxiety were 16.50 ± 2.56 under the neutral instructions and 16.75 ± 1.58 under the ego-threatening instructions. A correlated *t*-test indicated that this difference was not significant ($t_7=0.22$, $P>0.05$). These findings were taken as confirmation that the experimental manipulation had been successful, and that it was therefore appropriate to proceed to an analysis of the performance data.

Performance data analysis

As predicted by the hysteresis hypothesis, the analysis of the performance data revealed a significant cognitive anxiety × heart rate × direction interaction ($F_{4,28}=5.91$, $P<0.001$). As a follow-up to this interaction, Tukey's test was used to perform a pairwise comparison of all 20 cell means. This indicated that performance at frequency band *M−10 in the high* cognitive anxiety, heart rate increasing condition was significantly better than performance in all other conditions. No other differences were significant (see Table 1 and Figs 2 and 3). Besides the three-way interaction already reported, there were a number of other significant interactions and

Table 1 Bowls performance cell means in the high and low cognitive anxiety conditions ($\bar{x}\pm$S.D.)[a]

	High cognitive anxiety		Low cognitive anxiety	
Heart rate frequency band	Heart rate increasing	Heart rate decreasing	Heart rate increasing	Heart rate decreasing
M−40	0.50±0.13	0.54±0.07	0.51±0.10	0.54±0.19
M−30	0.65±0.22	0.59±0.11	0.55±0.11	0.52±0.10
M−20	0.72±0.23	0.67±0.21	0.65±0.19	0.58±0.12
M−10	1.33±0.75	0.48±0.15	0.52±0.08	0.48±0.07
MAX	0.48±0.34	0.38±0.07	0.49±0.06	0.51±0.07

[a] The original error scores were measured in metres and then transformed into performance scores using the transformation $f(x)=1/x$. The critical difference for Tukey's follow-up test in the significant three-factor interaction was 0.39.

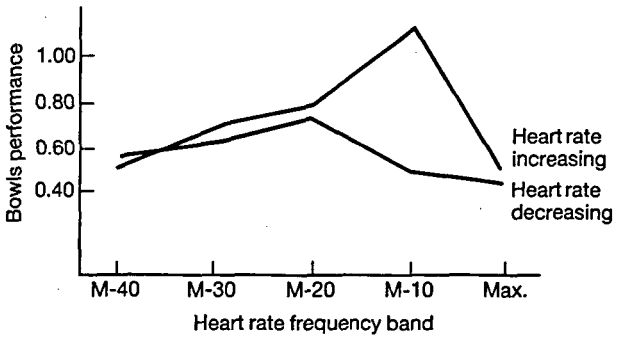

Figure 2 Bowls performance in the high cognitive anxiety condition. The original error scores were measured in metres and then transformed into performance scores using the transformation $f(x)=1/x$.

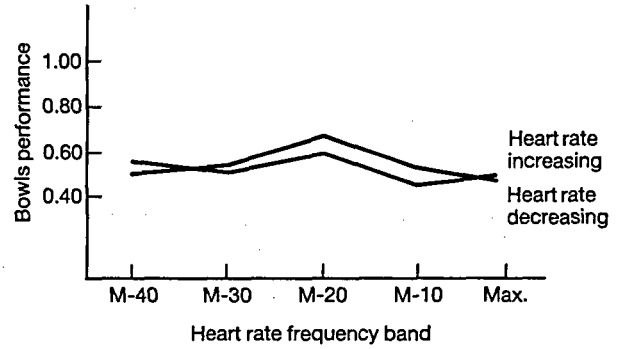

Figure 3 Bowls performance in the low cognitive anxiety condition. The original error scores were measured in metres and then transformed into performance scores using the transformation $f(x)=1/x$.

main effects. These effects were not of relevance to the hypotheses being tested, and consequently are not reported here.

The second hypothesis to be tested was that each subject's best performance would be significantly better under conditions of high cognitive anxiety than under conditions of low cognitive anxiety. This hypothesis was tested using a correlated *t*-test of each subject's best score in the high cognitive anxiety condition against his best score in the low cognitive anxiety condition. The correlated *t*-test indicated that subjects' best performances were significantly better in the high cognitive anxiety condition than in the low cognitive anxiety condition ($t_7=4.05$, $P<0.005$).

Finally, the third hypothesis to be tested was that each subject's worst performance would be significantly worse under conditions of high cognitive anxiety than under conditions of low cognitive anxiety. This hypothesis was tested in the same way as the second hypothesis using a correlated *t*-test. The correlated *t*-test indicated that the subjects' worst performances in the high cognitive anxiety condition were significantly worse than their worst performances in the low cognitive anxiety condition ($t_7=-3.62$, $P<0.01$).

Discussion

The results indicated that cognitive anxiety was manipulated independently of somatic anxiety and, following this manipulation, a significant cognitive anxiety × heart rate × direction interaction upon performance indicated that hysteresis did occur in the high cognitive anxiety condition, but not in the low cognitive anxiety condition. The results also indicated that under conditions of high cognitive anxiety, subjects' best performances were significantly better, and their worst performances significantly worse, than under conditions of low cognitive anxiety. However, the results were not unequivocal. Even though hysteresis did occur in the high cognitive anxiety condition, there was no really clear evidence of a considerable reduction in heart rate being necessary before subjects 'flipped' back onto the upper performance surface. In fact, the Tukey's tests of the three-way interaction on the performance data revealed no significant differences among the different heart rate frequency bands in the high cognitive anxiety, heart rate decreasing condition. Consequently, it could be argued that the hysteresis effect was largely a result of small subject numbers and 'wild' scores in the high cognitive anxiety, heart rate increasing, M−10 condition. However, the authors would prefer to argue against such an interpretation on the following grounds. First, although there were only eight data points in each condition, the total number of data points used for the main analysis was 160, making it highly improbable that 'wild' scores should occur at precisely the 'right' point and in precisely the right 'direction'. Second, each data point was itself the mean of three trials, thereby reducing the influence of outliers. Finally, this is the second experiment to use this paradigm in which subjects have produced peak performances in the high cognitive anxiety, M−10, heart rate increasing condition (cf. Hardy and Parfitt, 1991).

A further criticism which could be levelled at this interpretation of the results relates to the fact that, in the high cognitive anxiety condition, performance at the MAX frequency band was not significantly worse than performance in the M−40, M−30 or M−20 frequency bands. However, Thom's (1975) theory does not imply that performance should remain *static* on the upper and lower performance surfaces of cusp catastrophes. It implies that performance should vary continuously on these two surfaces and shift *discontinuously* between them. Furthermore, Thom's original theorem showed that (subject to certain conditions) all naturally occur-

ring discontinuities could be modelled by surfaces that were *topologically isomorphic* to one of his seven *characteristic* catastrophe surfaces. Thus, cusp catastrophe models do not all look exactly like the surface obtained with Zeeman's (1976) machine. Rather, they are surfaces which can be bent, stretched, rotated and transformed (but not torn) to fit the characteristic cusp catastrophe surface. The essential features of cusp catastrophes are, therefore, hysteresis and discontinuous changes in performance under certain conditions. The precise locations in space of the upper and lower surfaces are simply details of the particular model under consideration. Consequently, the present results do provide quite good support for *a* catastrophe model of anxiety and performance (despite the small sample size), but they provide only partial support for Fazey and Hardy's (1988) catastrophe model. In particular, they do not support Fazey and Hardy's prediction that performance should be high when cognitive anxiety is high but physiological arousal is low. Quite why this should be is not clear, since the results certainly do not offer any support for the multidimensional anxiety theory view that cognitive anxiety always has a negative effect upon performance (Martens *et al.*, 1990; Morris *et al.*, 1981).

One could also argue that the hysteresis finding does not sit very comfortably with previous research that has reported a quadratic relationship between somatic anxiety and performance (Burton, 1988; Gould *et al.*, 1987). However, the authors would prefer to argue that this apparent contradiction is an artifact of the different designs and analyses that have been used in these studies. Ignoring for a moment the distinction between physiological arousal and somatic anxiety, the polynomial regression analysis used by Burton (1988) and Gould *et al.* (1987) does not consider any possible interaction between cognitive and somatic anxiety, and essentially projects the performance data onto the performance × physiological arousal (somatic anxiety) plane at the back of the catastrophe model shown in Fig. 1. In making such a projection, the 'dual surface' zone of the behaviour surface would become considerably 'blurred' or even disappear, leaving in its place a quadratic relationship such as the ones reported by Burton (1988) and Gould *et al.* (1987). Having stated all this, the distinction that is made in the catastrophe model between physiological arousal and somatic anxiety is an important one which should be borne in mind in any future studies that might attempt to compare the predictive power of the catastrophe model with that of multidimensional anxiety theory. One obvious way to perform such a comparison would be to utilize three-dimensional surface fitting procedures of the type proposed by Guastello (1987) to compare the variance accounted for by the different models.

Even if the catastrophe model could be shown to provide an accurate description of *what* happens to performance under conditions of high anxiety, much more interesting questions would remain about *how* such changes come about. Current attempts to explain the effects of anxiety upon performance are usually either attentional or motivational in nature. For example, following Wine (1971), it is commonly argued that anxious subjects' preoccupation with their own internal state leads to interference effects upon performance by a reduction in the attentional resources that are effectively available to the performer (Humphreys and Revelle, 1984). Alternatively, Eysenck (1979, 1982) has suggested that the difference between current aspirations and previous levels of achievement is larger in highly anxious subjects than in low-anxiety subjects. According to Eysenck (1982), these greater goal discrepancies lead to enhanced motivation and effort provided the task is not too difficult. However, if the task is so difficult that subjects do not perceive themselves as standing a reasonable chance of success, then they do not accept the challenge. Consequently, motivation and effort are reduced, and performance is impaired (cf. Locke and Latham, 1985). Furthermore, it is possible that in both the present experiment and the one performed by Hardy and Parfitt (1991), increases in physiological arousal were simply a reflection of the effort that the subjects were having to invest in the task. If this was the case, then Eysenck's (1982) explanation would fit the data quite well, since one might reasonably expect that after a catastrophic fall-off in performance, physiological arousal would have to be considerably reduced before subjects would feel able to invest the extra effort required to attain the upper performance surface (Hardy, 1990).

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